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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/559,864 | 05/01/2006 | Natacha Haik-Beraud | Serie 6095 | 7435 |

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American Air Liquide, Inc.
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| EXAMINER | |
|---|---|
| NGUYEN, NGOC YEN M | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1734 | |

| NOTIFICATION DATE | DELIVERY MODE |
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| 06/09/2011 | ELECTRONIC |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/559,864 | HAIK-BERAUD ET AL. | |
| | Examiner | Art Unit | |
| | Ngoc-Yen Nguyen | 1734 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *30 November 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *13-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *13-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

**DETAILED ACTION**

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 30, 2010 has been entered.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 16-20, 23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 16, it is unclear if step (b) as required is the same or different than the step (b) in the independent claim 13.

In claims 17-18, steps (e) and (f) are required, however, there are no steps (c) and (d).

Claims 16-18 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s)

in proper dependent form, or rewrite the claim(s) in independent form. In the independent claim 13, it is required that the gas stream to be treated contains both oxygen and unsaturated hydrocarbon; however, in claims 16-18, the gas stream contains "at least one impurity selected from oxygen ($O_2$) and unsaturated hydrocarbons".

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 13-15, 17-18, 20-22, 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carr (5,451,384) in view of Pham et al (6,548,440) and Krueger (4,034,062).

Carr '384 discloses a process for substantially removing the metal carbonyl content of a gas stream comprised at least 5 mol% of carbon monoxide, the process comprising contacting the gas stream with lead oxide dispersed on a support under conditions such that the metal carbonyl in the gas is removed (note column 3, lines 20-24). The metal carbonyl can be iron carbonyl, nickel carbonyl (note claims 2-3).

The gas stream to be treated can be synthesis gas for use in processes such as ammonia synthesis, methanol synthesis, Fischer-Tropsch synthesis (note column 3, lines 56-62). The synthesis gas comprises 10-90% by volume carbon monoxide, about

10-about 90% by volume hydrogen, and 0 to 80% by volume of nitrogen, the balance being made up of other gaseous components such as carbon dioxide, methane, higher hydrocarbons and oxygenated hydrocarbons, hydrogen sulphide, water, argon and traces of noble gases (note paragraph bridging column 3-4).

Carr '384 teaches that the advantages of using a PbO on gamma alumina sorbent are many. The removal is fast. It may involve a chemical reaction and/or a strong physical adsorption. The loading of Fe deposited from $Fe(CO)_5$ removal can be very high. These factors are conducive to commercially attractive performance: a high capacity for Fe capture, the long life of the sorbent and the ability to use small removal reactors because of fast rates of removal (note column 3, lines 38-46). The lead oxide is termed as "sorbent" in the invention of Carr '384 (note column 4, lines 42-43). Thus, the lead oxide dispersed on a support as disclosed in Carr '384 is considered the same as the claimed "second adsorption bed".

The gas hourly space velocity of about 1000 GVHSV is used (note Example2). This value overlaps the claimed range at 1000. In any event, it would have been obvious to one skill in the art to optimize the gas hourly space velocity to effectively remove the metal carbonyl with the fastest possible rate.

For claim 17, Carr '384 discloses that the sulphur compounds, such as $H_2S$, will poison the catalysts used in processes downstream of the metal carbonyl trap. It is also known that certain sulphur compounds will compete with the removal of metal carbonyls from the gas stream. Accordingly, the gas stream is preferable free from sulfur compounds. Various sulfur compounds may be removed from the gas stream by

any of the methods well known in the art. Such methods include, for example the use of zinc oxide for $H_2S$ removal (note column 4, lines 11-20). The zinc oxide is considered as the first adsorption bed. For the order to removing the sulfur compound, it would have been obvious to one skilled in the art to remove the sulfur compounds in any order as long as they are removed before the gas stream comes into contact any catalyst.

The difference is Carr '384 does not disclose the step of treating the gas stream, after removing metal carbonyl impurity, to remove oxygen and hydrocarbon.

Pham '440 discloses that in a Fischer-Tropsch process, it is preferred in the art to purify the syngas used as the starting material (i.e. a gas stream comprising hydrogen and carbon monoxide) to remove oxygen, iron carbonyls, water and hydrocarbon impurities (note column 16, lines 40-45).

Krueger '062 discloses a process for the purification of a gas stream containing primarily hydrogen and carbon monoxide as well as small quantities of oxygen, acetylene and ethylene as impurities, comprising passing said gas stream at a temperature of 250 to 700°F (121-371°C) through a bed of catalyst consisting essentially of a copper catalyst (note claim 1).

Krueger '062 further teaches that hydrogenation processes for removing oxygen, acetylene and ethylene are well known and no departures from well-known hydrogenation processes are required herein. The pressure is in the range of 100 to 500 psig (6.9 to 34.5 bar) (note column 1, lines 65-67). The space velocity is in the range of 2,000 to 10,000 gas volumes per volume of catalyst per hour, depending on

the type of catalyst used (note column 1, line 67 to column 2, line 2). These ranges overlap the claimed ranges. With respect to the encompassing and overlapping ranges previously discussed, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time of invention to select the portion of the prior art's range which is within the range of the applicants' claims because it has been held prima facie case of obviousness to select a value in a known range by optimization for the results. *In re Boesch*, 205 USPQ 215. Additionally, the subject matter as a whole would have been obvious to one of ordinary skill in the art at the time invention was made to have selected the overlapping portion of the range disclosed by the reference because overlapping ranges have been held to be a prima facie case of obviousness. *In re Malagari*, 182 USPQ 549.

The step of contacting the synthesis gas with the copper catalyst as disclosed in Krueger '989 would inherently remove any $NO_x$ compounds that may be present in the synthesis gas.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to remove oxygen and hydrocarbon contained in the synthesis gas of Carr '384 by the method as suggested by Krueger '989 because Pham '440 teaches that these impurities need to be removed before the syngas is used in a Fischer-Tropsch process.

Claims 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Carr '384 in view of Pham '440 and Krueger '062 as applied to claims 13-15, 17-18, 20-22, 24 above, and further in view of Heyd (4,740,361) and Britton et al (4,175,928).

The difference not yet discussed is Carr '384 does not disclose the step of removing organosulfur compound.

Heyd '361 teaches that syngas commonly contains organosulfur compound, such as methyl mercaptan as impurity in addition to inorganic sulfur compound, such as hydrogen sulfide.

Britton '928 discloses that it is known in the art to remove sulfur compounds, organic sulfur compounds from synthesis gas by first converting them to hydrogen sulfide in a catalytic hydrogenation reactor and the hydrogen sulfide is then adsorbed from the synthesis gas stream by passing it through a suitable sorbent (note column 1, lines 64-68).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to remove organosulfur compound, which is commonly contained in syngas, as suggested by Heyd '361, from the syngas in the process of Carr '384 by using the method of Britton '928 to improve the purity of the syngas.

Claims 18-19, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carr '384 in view of Pham '440 and Krueger '062 as applied to claims 13-15, 17-18, 20-22, 24 above, and further in view of Bancon et al (2003/0126989) and Engelbrecht et al (4,320,100).

The difference not yet discussed is Carr '384 does not disclose the presence of $NO_x$ and the step of removing it.

As stated above, the step of removing oxygen and hydrocarbon as suggested by Krueger '062 would inherently remove any NOx present in the syngas.

In any event, Bancon '989 is applied to teach that synthesis gas may contain other impurities such as light hydrocarbon impurities, $CO_2$ and/or $NO_x$ (note paragraphs [0020] and [0030]).

Engelbrecht '100 is applied to teach that it is conventional in the art to remove nitrogen oxide and oxygen from a synthesis gas by passing the gas over a hydrogenation catalyst at a temperature of from 120 to 250°C and at a pressure of from 0.5 to 250 bar (note claim 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to remove nitrogen oxide, which is a common impurity in synthesis gas as suggested by Bancon '989, from the synthesis gas of Carr '384 by the method as suggested by Engelbrecht '100 because Engelbrecht '100 teaches that the desire to remove the nitrogen oxide impurity from synthesis gas.

Bancon '989 can be further applied to teach that If the amount of $CO_2$ contained in the stream of syngas to be purified is greater than several thousands of ppm, it is firstly washed with amines (MEA or MDEA type) to remove most of the $CO_2$. The gas is then sent to a column of adsorbent(s) to remove the residual traces of $CO_2$ (a few tens of ppm) not removed by the washing with amines and possibly the other impurity or impurities present in the syngas, for example water that is often present at the same

time as $CO_2$ (after washing with the amines, the gas is saturated with water) (note paragraph [0007]).

Applicant's arguments filed November 30, 2010 have been fully considered but they are not persuasive.

Applicants argue that Carr '384 teaches that copper catalysts as being "hydrogenation catalysts" which "can convert some of the syngas to methane and alcohols"; hence Carr '384 expressly teaches away from claim 13 of Applicants' claimed invention.

Carr '384 teaches that the use of copper catalyst to remove metal carbonyls is undesirable (note column 2, lines 42-60); however, Carr '384 does not use copper catalyst. In the process of Carr '384, lead oxide is used to remove metal carbonyls. Furthermore, the disclosure in Carr '384 (column 2, lines 54-60 as referred to by Applicants) is for the step of removing metal carbonyls, not for any other steps of removing other impurities. It would have been obvious to one skilled in the art to balance out any benefit by using a copper catalyst in any step of removing impurities from a synthesis gas ($CO/H_2$ gas) with any loss of the syngas due to formation of methane and alcohols.

The rejections of claims 16, 18-19 and 23 are maintained for the same reasons as stated above.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ngoc-Yen Nguyen whose telephone number is (571)272-1356. The examiner can normally be reached on Part time schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Emily Le can be reached on (571) 272-0903. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ngoc-Yen M. Nguyen/
Primary Examiner, Art Unit 1793

nmn
June 6, 2011